Sports Injuries Unique to the Pediatric Population

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Disclosures

- None
- I do have a dog
- Been married for 27 years
Objectives

- Review the growth plate and overuse injuries that can occur to them.
- Review growth plate fractures
- Review osteochondritis dissecans

Anatomy - Terms often used interchangeably

- Epiphysis - End of a long bone, secondary center of ossification
- Physis - Epiphyseal growth plate
- Apophysis - aka traction epiphysis
- Metaphysis - Flared area of long between physis and diaphysis
- Diaphysis - Cancellous bone in middle of long bone
Growth Plate Injuries

- Overuse injuries occur at the weakest part of the musculotendinous junction, the physis.
- Hypertrophic zone is weakest area of physis.

- Repetitive trauma weakens the physis and subsequent trauma may fracture the involved physis.
- Physis can be weaker than ligaments and muscle-tendon junctions.
- Problems often occur during growth spurt.
- Pain often ceases when growth ceases.
- Anatomic variants may predispose to overuse injuries.
Secondary Ossification Centers

Fractures in Children, Rockwood et al 1991

Tibial Apophysitis (Osgood-Schlatters Disease)

- Presentation
  - Pain with activity over the tibial tuberosity in males ages 10-15 and females ages 8-13.
  - Increased size and pain with palpation of the tibial tuberosity.
  - Bilateral 25-50%
Tibial Apophysitis (Osgood-Schlatters Disease)

Treatment
- Must differentiate from tibial tubercle avulsion.
- Quadriceps/hamstring stretching.
- Activity limited by symptoms. Padding may help.
- After maturation, separate bony ossicle may be removed if chronically painful.

Avulsion
- Acute etiology usually resisted knee extension
- Immediate pain and swelling
- Nondisplaced- Extension cast ~4 weeks (controversial)
- Displaced- ORIF
Distal Patellar Apophysitis (Sinding-Larsen-Johansson Syndrome)

- Apophysitis of the distal pole of the patella.
- Treat similar to tibial apophysitis
- X-ray Osgood-Schlatters and SLJ

Multipartite Patella

- 0.2-6% of population
- Male predominance 9:1
- Etiology not clear
  - Poor blood flow to superolateral patella
  - Traction from vastus lateralis
  - Old trauma
  - Separate ossification center- can begin to ossify as early as 2 yo. Usually ossifies at 5-6
Bilateral Bipartite Patella

Same Knees 3 years later
Multipartite Patella- Treatment

- If traumatic may be fracture
- If traumatic, usually treat with brief immobilization for 3-4 weeks
- If overuse can try relative rest for 3-4 weeks and if not successful, immobilization
- Some may need surgical excision


Medial Epicondylar Traction Apophysitis (Little Leaguer's Elbow)

- Presentation
  - Ages 9-12
  - Pitchers lose control
  - Medial epicondylar pain and swelling
  - Medial elbow pain with valgus stress or resisted wrist flexion or pronation
  - Limited elbow extension
  - Most common cause is pitching while fatigued
Medial Epicondylar Apophysitis

- Radiographic findings
  - Medial epicondylar enlargement, cortical thickening, fragmentation, or separation.
  - May see osteochondritis of capitellum
  - May need comparison x-rays
Medial Epicondylar Apophysitis

- Treatment
  - 2 to 3 weeks of rest and ROM with gradual return to throwing at about 6 weeks.
  - ROM/Strengthening of flexor/pronator group
  - ORIF if displaced

Pitching

- Survey conducted by Joe Chandler MD (2000) of 101 Atlanta Braves pitchers
- Average age started
  - Fastball 10 years
  - Curveball 14
  - Change-Up 17
  - Slider 18
- Average age would allow son to start
  - Change-Up 12
  - Curveball 15
  - Slider 17
**Calcaneal Apophysitis (Sever's Disease)**

- Present with pain at the insertion of the achilles tendon or calcaneus and limp.
- Ages 7-12
- High association with foot and ankle abnormalities including varus deformities of the foot and ankle and tight heel cords.
- Pain with medial/ lateral compression of calcaneus

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**Calcaneal Apophysitis**

- X-ray shows dense calcaneal apophysis.
- Treat conservatively with relative rest, stretching, heel cups/lifts, and correction of biomechanical abnormalities.
Traction Apophysitis about the Pelvis

- Can occur at the ASIS (sartorius), AIIS (rectus femoris), iliac crest (gluteus medius and abdominals anteriorly and the gluteus maximus and latissimus posteriorly), greater trochanter (gluteus medius and minimus), lesser trochanter (iliopsoas), or the ischial tuberosity (hamstring).

Traction Apophysitis about the Pelvis

- Pain with resisted motion and palpation
- X-ray may show widening of the apophysis or an avulsion fracture
- Look for leg length inequality
Iliac Crest Apophysitis

Traction Apophysitis about the Pelvis

- Treatment
  - Relative rest 2-4 weeks
  - Range of Motion
  - Full activity usually in 4-6 weeks
Traction Apophysitis about the Pelvis

- Treatment - Avulsion Injuries
  - Usually treated conservatively
    (Snyder Sling) Rest-O-Flex
  - Full activity in 3-4 months
  - Some advocate ORIF

- Rest-O-Flex brace
  - Make sure brace does not rub on injured area
Iliac Crest Avulsion

Iliac Crest Avulsion
ASIS Avulsion

ASIS Avulsion 6 weeks later
AIIS Avulsion

[Image of an X-ray of the pelvis]

AIIS Avulsion

[Image of an MRI scan of the pelvic area]
Ischial Tuberosity Avulsion

Proximal Humeral Apophysitis (Little Leaguer's Shoulder)

- Overuse injury of the proximal humeral physis
- Pain at deltoid insertion with throwing
- X-ray: widened humeral physis - get comparison views
- Complete throwing cessation for 6 weeks
Little Leaguers Shoulder-comparison views

Little Leaguers Shoulder-comparison views 6 weeks later
Proximal Humeral Physis

Normal variant
Slipped Capital Femoral Epiphysis

- **Epidemiology**
  - 0.7-3.4/100,000
  - Male > Female
  - 11-15 years old
  - 10-20 (41)% bilateral
- **Etiology unclear** - genetic, hormonal (thyroid), mechanical
- **Presentation**
  - Hip (groin) pain
  - Pain may refer to knee
  - Decreased internal rotation

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**Slipped Capital Femoral Epiphysis**

- Bilateral AP pelvis and frog lateral will show slip
- Treatment is surgical
Slipped Capital Femoral Epiphysis
Slipped Capital Femoral Epiphysis

Slipped Capital Femoral Epiphysis - Treatment
Fifth metatarsal (Iselin's disease), accessory navicular

Physeal Fractures

- Salter Harris classification scheme
Physeal Fractures

- **Salter 1 Fracture**
  - If physis locally tender, treat as fracture even with normal x-ray - most common is distal fibula and distal radius

- **Salter III-V**
  - Can affect epiphyseal blood supply

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**Salter 1 Distal Radius**
Salter 1 Distal Radius 4 weeks later

Salter 1 Proximal Phalanx
Salter 1 Distal Fibula

Salter 1 Proximal Humerus
Greenstick (Torus) Fracture

Osteochondritis Dissecans

- Avascular segment of subchondral bone causing involution of bone and collapse overlying articular cartilage
  - Articular surface may remain completely attached (stable), partially attached or become loose (unstable)
  - Patients with OCD with closed physis (adult OCD) usually have poorer results than those with open physis (juvenile OCD).
Osteochondritis Dissecans

- Most common area is knee; also elbow and ankle
  - 80% on lateral aspect of medial femoral condyle
  - Prevalence- 30-60/100,000
  - Juvenile form usually presents in teens
  - Bilateral in 20-40%
  - M:F-3:1
- Etiology multifactorial- trauma, avascular necrosis, endocrine, familial

Osteochondritis Dissecans

- Presentation
  - Poorly localized, aching knee pain with activity ± swelling
  - May progress to mechanical symptoms
  - PE
    - Full ROM
    - Effusion
    - Wilson test- Seated position- pain during active knee extension with the tibia internally rotated. Should have no pain with active extension with tibia externally rotated
Osteochondritis Dissecans

- **X-ray**
  - Tunnel view usually best at visualizing OCD fragment
  - Radiolucent semicircle around fragment of bone
  - May show healing after 3-6 months of treatment

Osteochondritis Dissecans - X-ray
11 months later
Osteochondritis Dissecans

- MRI
  - Images articular surface
  - Can give information on stability of fragment and healing
  - Bone scan activity shows ability to heal

Osteochondritis Dissecans MRI
Osteochondritis Dissecans

[Images of knee and elbow radiographs]

Osteochondritis Dissecans

[Images of knee MRI scans]
Elbow OCD

Conservative Treatment in juvenile OCD
- Use in patient with physis with no mechanical symptoms (stable)
- Activity modification for 6-12 weeks
  - Limited immobilization and minimal weight bearing for 1-2 weeks
  - Limit rapid, strenuous activities e.g., running
- Full activity when:
  - No complaints
  - Normal exam
  - Radiographic evidence of healing
- If no improvement after ~6 weeks- MRI or bone scan

Osteochondritis Dissecans - Treatment
Osteochondritis Dissecans - Treatment

- Patients with open physis have better chance of healing
- OCD of lateral femoral condyle usually do poorer than medial condyle.

Osteochondritis Dissecans - Treatment

- Surgery after failed conservative management or patients with unstable fragment
  - Need to have smooth articular surface and promote vascular ingrowth
  - Procedures include transarticular drilling, fragment fixation, and bone grafting
  - Loose body removal
Discoid meniscus

- Enlarged meniscus covering tibial condyle
- Congenital -v- Acquired
- Usually lateral
- See snapping in knee and tears
- Intermittent effusion
- May lack full extension even between episodes
- Treatment of symptomatic discoid meniscus is surgical
Avascular Necrosis

Tarsal Navicular (Koehler's Disease)

- Epidemiology
  - Ages 3-8
  - Male/Female- 6/1
  - 30% bilateral

- Presentation
  - Antalgic gait
  - Pain along longitudinal arch and over navicular

AVN Tarsal Navicular

- X-ray
  - Avascular necrosis of navicular
  - Will usually have normal navicular after several months
AVN Tarsal Navicular

Treatment
- Aim is to maintain bony contour
- Well molded cast for 4-6 weeks
- Medial arch supports
- Activity modification
- Treatment failure sometime leads to surgery

AVN 2nd or 3rd metatarsal
(Freiberg's Infarction)

Epidemiology
- Female > Male
- Teens
- Morton’s toe more common
- Etiology unclear
AVN 2nd or 3rd metatarsal (Freiberg's Infarction)

- X-ray
  - AVN with flattening of metatarsal head
- Treatment
  - May cast initially
  - Metatarsal pads/ low heels
  - Surgery for refractory cases